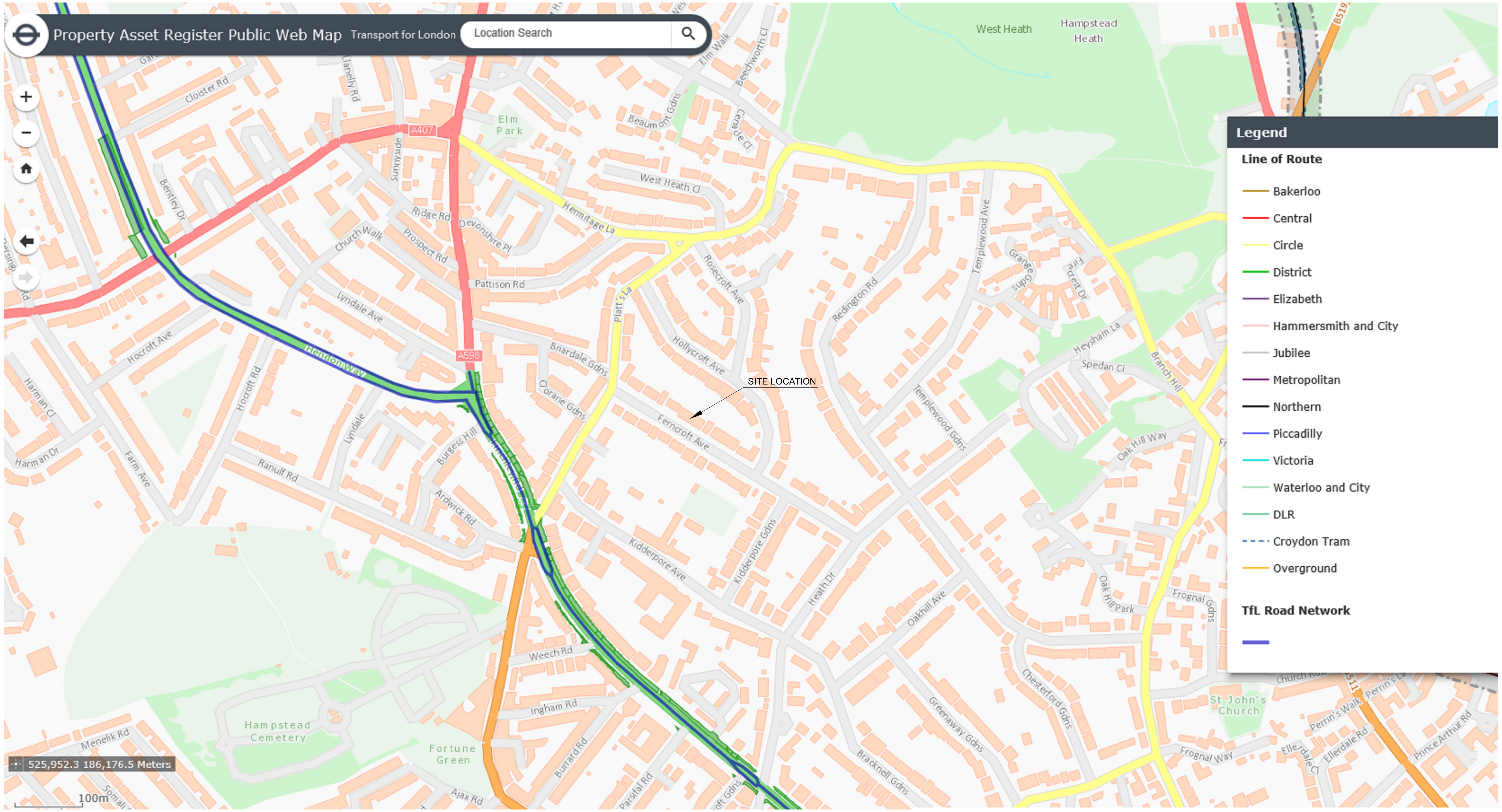
DO NOT SCALE



MK	REVISION	BY	DATE
-	-	-	-

DRAWING STATUS

PLANNING

DRAWING TITLE

TRANSPORT FOR LONDON PROPERTY ASSET REGISTER

PROJECT — Project Number - P19-461

20A FERNCROFT AVENUE,
LONDON,
NW3 7PH,

simpson | tws

3 Dufferin Avenue
Barbican
London, EC1Y 8PQ
T: 020 7253 2626
E: mail@simpsoneng.com
W: www.simpsoneng.com

London, Henley-on Thames, Gloucester and Exeter

Drawn	Ch'kd	Scales	Date
GB	Ch'kd	NTS	29.10.19

Purpose of Issue

BASEMENT IMPACT ASSESSMENT

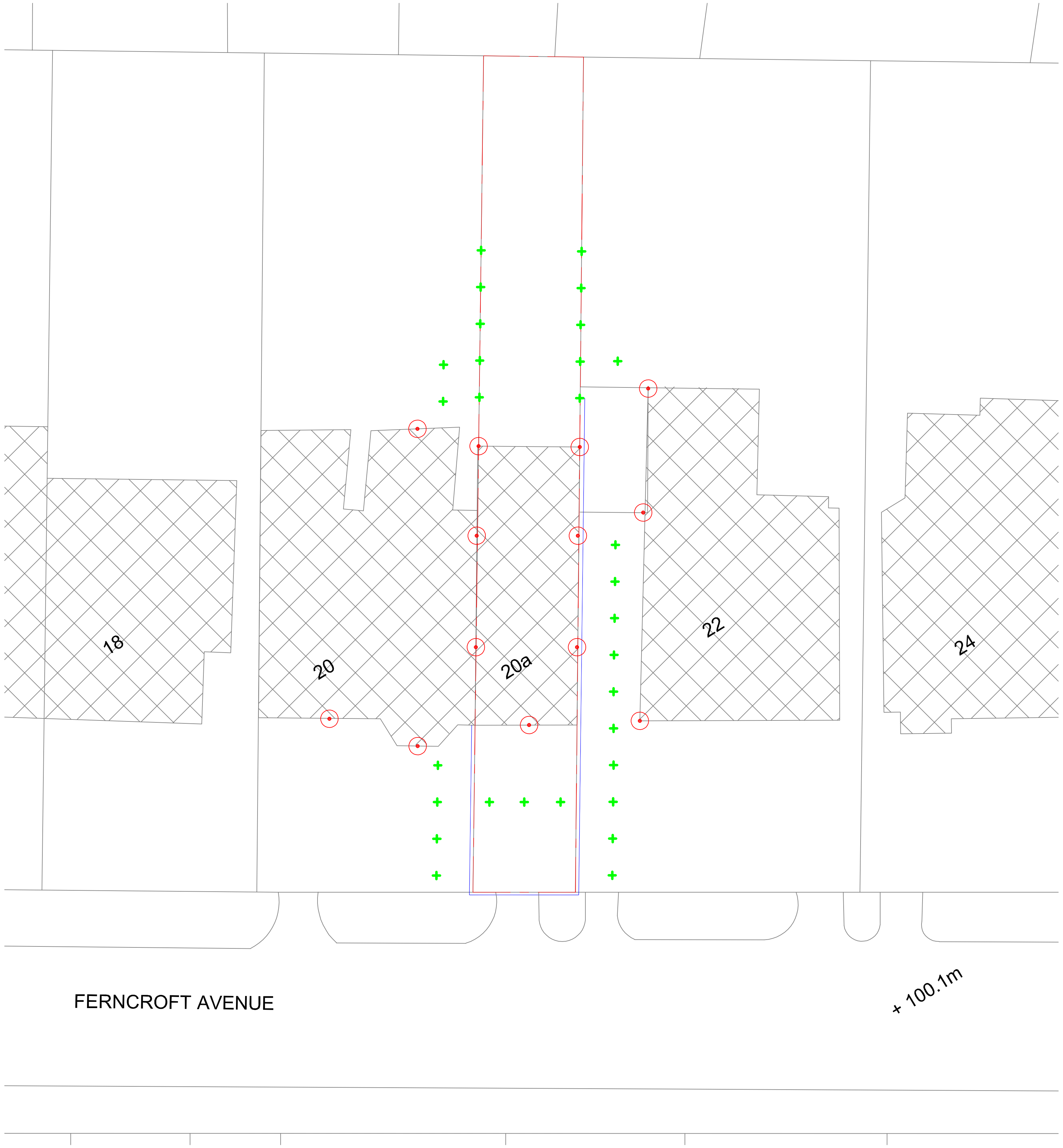
Drawing Number	Revision
P19-461_SK09	-

A3

Appendix H

SIMPSON P19_461_SK10_Proposed Monitoring of Movement and Settlement to site and surrounding area.

DO NOT SCALE



All readings are to be reported to the Supervising Officer and additional members of the team (TBC) within 48 hours of them being made.

The surveying company is to provide a movement survey report with all readings to be provided in a spreadsheet format with accompanying graphs indication the development of each observation with time and appropriate suitable profiles. The accompanying text is to be provided highlighting any trends that are or are likely to be encountered and also record against them the type of work undertaken prior to the readings. Each report is to be dated and referenced and have the site location plan included for easy of locating survey points

If any unusual observations or observations suggesting excessive deformation and/or possible instability are made these should be checked and if confirmed, reported to the Contractor and Engineer immediately.

The survey company is to review the positions show are suitable for surveying from agreed base positions and positions are subject to final site survey.

The survey company is to provide a method statement confirming how the works are to be undertaken giving details of all equipment to be used with data sheets confirming up to date equipment calibration.

Timing of readings (grd level, survey & monitoring)
An initial base reading is to be undertaken 1 month prior to and at start on site and then every 2 weeks from start of Underpinning, Excavation and casting of lower ground floor structure.
If casting of slabs or removal of propping falls within the 2 week period then take additional reading in between at 1 week.
Once the lower basement works are completed level readings are to be taken every 2 weeks for 2 months and if a trend of reducing rate of movement is established then revert to readings every 4 weeks
If during any of the readings excessive movement is noted revert to 1 week readings until 2 weeks after readings show excessive movement has stop. Then revert back to readings every 4 weeks.

Movement Limits and Responses (No. 20 FERNCROFT AVENUE)

Action Level	Response	Ground Surface Level Vert., mm	Ground Surface Level Horiz., mm
Green	No Action	<7	<7
Amber	Re-assess and agree course of action	7 to 10	7 to 10
Red	Stop works and secure adjoining the area	>10	>10

Stated movement limits and responses are subject to final agreement as part of the party wall process with adjoining party wall surveyors

Movement Limits and Responses (No. 22 FERNCROFT AVENUE)

Action Level	Response	Ground Surface Level Vert., mm	Ground Surface Level Horiz., mm
Green	No Action	<7	<7
Amber	Re-assess and agree course of action	7 to 10	7 to 10
Red	Stop works and secure adjoining the area	>10	>10

Stated movement limits and responses are subject to final agreement as part of the party wall process with adjoining party wall surveyors

KEY

- Surface levelling studs (~5m c/c)
- Wall(s); precise leveling at ground level (2m c/c by excavation)
- Structures(s); 3D Retro-targets top & bottom of wall (Final locations to be agreed)

The movement limits noted on this drawing are taken from basement impact assessment

The contractor is to review this and all other relevant documentation and It is the contractor's responsibility to review the monitoring results and to maintain all ground and building movement within the design parameters and where possible improve upon.

The limits given in the table are the maximum and not to be exceeded and if at any time it is deemed that the movement are likely to be exceeded, the contractor is to make all necessary arrangement to bring the movement back to within the acceptable limits for the relevant phase or works.

The contractor is to immediately notify the Supervising Officer and Design Team of any such situation and the proposed remedial works.

MK	REVISION	BY	DATE
-	-	-	-

DRAWING STATUS
PLANNING

DRAWING TITLE
PROPOSED MONITORING OF MOVEMENT AND SETTLEMENT TO SITE AND SURROUNDING AREA

PROJECT — Project Number - P19-461
20A FERNCROFT AVENUE,
LONDON,
NW3 7PH,

simpson | tws
3 Dufferin Avenue
Barbican
London, EC1Y 8PQ
T: 020 7253 2626
E: mail@simpsoneng.com
W: www.simpsoneng.com
London, Henley-on Thames, Gloucester and Exeter

Drawn	Ch'kd	Scales	Date
GB	Ch'kd	NTS	29.10.19

Purpose of Issue
BASEMENT IMPACT ASSESSMENT

Drawing Number	Revision
P19-461_SK10	-

A3

Appendix I

Risk Management Limited Site Investigation report reference RML 7096 dated September 2019
Risk Management Limited updated monitoring results dated September 2019

Unit 10 Coopers Place
Combe Lane, Godalming
Surrey GU8 5SZ
Tel: 01883 343572
Fax: 01883 344060
email: enquiries@riskmanagementltd.co.uk
Web: www.riskmanagementltd.co.uk

PROJECT No. RML 7096

SITE INVESTIGATION
AT
20 FERNCROFT AVENUE, HAMPSTEAD

ON BEHALF OF
SIMPSON ASSOCIATES

September 2019

CONTENTS

APPENDICES

1.0 INTRODUCTION & SCOPE OF WORKS

1.1 This report has been prepared by Risk Management Limited under cover of signed Instructions to Proceed received from the Consulting Engineers, Messrs. Simpson Associates, dated 5th August 2019.

1.2 The site under consideration is No. 20 Ferncroft Avenue, Hampstead, London NW3 7PH.

1.3 It is understood that a full-storey basement is proposed under the existing semi-detached property, extending from just in front of the property to behind the house and into the garden.

1.4 The current work was commissioned to provide information on the sub-soil conditions at this site, together with laboratory testing, in order to allow foundations to be designed and a Basement Impact Assessment (BIA) to be undertaken by others.

1.5 This report presents the work carried out and discusses the findings.

2.0 FIELDWORK

2.1 Fieldwork was generally executed in accordance with the recommendations given in British Standard BS 5930:2015, "Code of Practice for Ground Investigations". Contamination sampling was undertaken in accordance with BS 10175 : 2011, "Code of Practice for the Investigation of Potentially Contaminated Sites".

2.2 Borehole and trial pit locations are shown on the appended Fieldwork Location Plan, Drawing No. RML 7096/1.

2.3 Fieldwork was undertaken on the 13th and 14th August 2019 and comprised the following:-

Light Percussion Borehole

2.4 One light percussion borehole (BH1) was drilled at the front of the site to a depth of 10.00m below existing ground level.

2.5 The drilling rig used was a Premier tracked drive-in-sampler rig which includes a 98mm diameter casing system driven into the ground with a series of 1 metre long metal tubes, varying in diameter from 80mm down to 35mm, driven through the casing to obtain disturbed samples at regular depth intervals.

2.6 Standard Penetration Tests (SPT's) were carried out within the borehole in order to provide information on the consistency of the material encountered. The appended SPT versus Depth Profile plots the 'N' values against depth for borehole BH1 at this site.

2.7 The Dynamic Probe employed comprises a weight of 63.6 kg dropping through a free-fall height of 762mm in accordance with British Standard BS 1377 : Part 9. The weight drives a 50mm diameter "split-spoon" sampler into the ground. The resistance to penetration is recorded for 6 consecutive 75mm increments with the SPT 'N' value calculated from an addition of the final four 4 readings.

2.8 Upon completion of borehole BH1 a combined groundwater/gas monitoring standpipe was installed to a depth of 6.50m below existing ground level.

2.9 The monitoring installation comprised a 1 metre length of plain 50mm diameter HDPE pipe followed by slotted geotextile wrapped HDPE pipe, capped at the base. A cement/bentonite seal was installed from 1.00m to ground level and the installation finished with a gas valve on top of the pipe and a lockable stopcock cover concreted in flush with ground level.

2.10 Full details of the light percussion borehole findings are given on the appended borehole record sheet.

Drive-in-Sampler Borehole

2.11 In addition to the above noted light percussion borehole, and due to access restraints, one drive-in-sampler borehole (DIS2) was drilled in the rear garden area to a depth of 5.00m below existing ground level.

2.12 The drive-in-sampler comprises a series of 1 and 2 metre long metal tubes, varying in diameter from 80mm down to 35mm, driven into the ground using a mini-hydraulic breaker unit. The tubes are subsequently jacked out of the ground and side windows enable the tubes to be cleaned and small disturbed samples to be taken at regular intervals within each stratum.

2.13 Small disturbed samples were taken at regular depth intervals down the borehole.

2.14 Upon completion of borehole DIS2 a combined groundwater/gas monitoring standpipe was installed to a depth of 5.00m below existing ground level.

2.15 The monitoring installation comprised a 1 metre length of plain 19mm diameter HDPE pipe followed by slotted geotextile wrapped HDPE pipe, capped at the base. A cement/bentonite seal was installed from 1.00m to ground level and the installation finished with a gas valve on top of the pipe and a lockable stopcock cover concreted in flush with ground level.

2.16 Full details of the drive-in-sampler borehole findings are given on the appended borehole record sheet.

Hand Excavated Trial Pits

2.17 In addition to the above noted boreholes, two hand excavated trial pits (TP1 & TP2) were undertaken against the sides of the existing property. Both locations were moved due to services encountered in the originally proposed locations.

2.18 Trial Pit TP1 found that the existing brick wall extended down and rested on a concrete footing at a depth of some 300mm below existing ground level. The concrete footing had a step out of 100mm and was found to extend down a further 120mm before the trial pit was terminated owing to a 150mm diameter plastic pipe encountered.

2.19 Trial Pit TP2 found that the existing brick wall extended down where it rested on a concrete footing at a depth of some 450mm below existing ground level. The concrete footing had a step out of 160mm and was found to extend down a further 750mm before the trial pit was terminated at a depth of 1.20m below existing ground level with the foundation continuing deeper.

2.20 Full details of the trial pit sections including photographs are given on the appended Figures 1 & 2.

Land-Borne Gas Monitoring

2.21 Following the initial site work, two return gas/groundwater monitoring visits have currently been undertaken to the installations fitted within boreholes BH1 and DIS2 on the 21st August 2019 and the 5th September 2019. One further monitoring visit is scheduled towards the end of September 2019 and the results of this monitoring visit will be issued as an addendum to this report.

2.22 On each visit, a GFM 436 portable gas analyser, manufactured by Gas Data Limited, was used to measure the barometric pressure together with the level of Carbon Dioxide, Oxygen and Methane. In addition, gas flow measurements were taken and the depth to groundwater recorded.

2.23 Full details of the readings are included on the appended Gas/Groundwater Monitoring Record Sheet.

3.0 GROUND CONDITIONS

3.1 According to information published by the British Geological Survey (Sheet 256, North London) the underlying geology at this site is shown as being Claygate Beds overlying London Clay of the Eocene Period.

3.2 The youngest part of the London Clay formation is known as the Claygate Member which form a transition between the deep water, dominantly argillaceous London Clay and the shallower water Bagshot Beds. Claygate beds occur widely in Surrey and generally comprise well-laminated orange-brown sands interbedded with pale grey clays and can be up to 15 metres thick near Claygate and Esher.

3.3 It is thought that the London Clay formation was deposited during a period of sea inundation in the area up to 200m in depth. The London Clay can be up to 150m thick beneath south Essex thinning across London to about 90m near Reading. The formation consists of mainly dark blue to brown grey clay containing variable amounts of fine-grained sand and silt. London Clay generally weathers to an orange-brown colour with pockets of silty fine sand. The formation is particularly susceptible to swelling and shrinking when subjected to moisture content changes. In addition, gypsum (selenite) crystals and pyrite nodules are commonly found throughout the formation.

3.4 Full details of the ground conditions encountered are presented on the borehole records appended to this report and can be summarised as follows:-

Depth From (m)	Depth To (m)	Description
0.00	0.15	Paving.
0.15	0.60/0.70	MADE GROUND.
0.60/0.70	4.60/5.00 +	Silty CLAY.
4.60	6.20	Clayey silty SAND (BH1 only).
6.20	10.00 +	Very silty CLAY (BH1 only).

3.5 Groundwater was encountered during boring, in both boreholes BH1 & DIS2, at a depth of 5.50m and 4.50m below existing ground level respectively.

3.6 Groundwater was also noted during the first two return monitoring visits to the installations fitted within the boreholes. Groundwater was found to range between 5.34m and 5.39m below existing ground level in borehole BH1 and between 2.57m and 2.71m below existing ground level in borehole DIS2.

3.7 Roots were not evident during boring.

4.0 LABORATORY TESTING

4.1 The following geotechnical and chemical laboratory tests have been carried out on samples recovered from the boreholes at this site.

4.2 Unless otherwise stated, the geotechnical tests have generally been carried out in accordance with the recommendations given in British Standard 1377:1990, “Methods of Test for Soils for Civil Engineering Purposes”.

4.3 The chemical testing was carried out in accordance with standard industry methods in a UKAS approved laboratory which is also currently accredited in accordance with MCERTS for the majority of its testing. Further information regarding this accreditation is available on request together with a full list of test methods if required.

4.4 *Natural Moisture Content Tests*

The natural moisture content has been determined for five samples of the underlying more cohesive deposits taken from borehole BH1 at depths of 1.00m, 2.00m, 3.00m, 4.00m and 7.00m below existing ground level.

The natural moisture contents were found to range between 12% and 38%.

4.5 *Atterberg Limits*

The Atterberg Limits have been determined for two samples of the underlying silty clay taken from borehole BH1 at 1.00m and 2.00m depth.

The liquid limits (LL) were found to be 62% and 66%, the plastic limits (PL) 28% for both samples and the plasticity index (PI) 34 and 38.

These results indicate that the samples tested would be classified as clay of ‘high’ plasticity (CH) in accordance with the Casagrande Geotechnical classification system.

In addition, both samples would be classified as having a ‘medium’ potential for swelling/shrinking in accordance with the National House Building Councils (NHBC) classification system given in Part 4 of their Standards, after correction for stone content.

4.6 *Quick Undrained Triaxial Compression Tests*

The undrained shear strength has been determined in single-stage triaxial compression for five, re-moulded, 38mm diameter samples at this site.

The resulting mean shear stress (undrained cohesion) C_u values ranged between 59 kN/m^2 and 114 kN/m^2 indicating that the samples tested at this site were 'firm' to 'stiff' in consistency.

4.7 *Particle Size Distribution*

The particle size distribution has been determined for one sample of the more granular soil encountered.

The result is presented as a grading curve in the appendix to this report.

4.8 *pH and Sulphate Tests*

The pH has been determined for three samples from across the site and was found to range between 5.3 and 9.6.

The sulphate content has been determined for two samples taken from borehole BH1 at 0.50m and 1.50m depth and was found to be, on a 2:1 water:soil extract, 0.10 g/l and 0.11 g/l.

4.9 *Chemical Analysis*

Two shallow samples of MADE GROUND were selected and tested for a range of commonly occurring contaminants and indicators of contamination including those given by the Contaminated Land Exposure Assessment (CLEA).

The contamination suite undertaken at this site includes speciated **P**oly**A**romatic **H**ydrocarbon (**PAH**) and speciated **T**otal **P**etroleum **H**ydrocarbon (**TPH**), together with **BTEX**, **B**enzene, **T**oluene, **E**thylbenzene and **X**ylenes.

4.10 *Asbestos Identifications*

The same two soil samples, as discussed above, were submitted to a UKAS accredited laboratory for asbestos identification and full details of the results are appended.

5.0 DISCUSSION

PROPOSED DEVELOPMENT & SCOPE OF WORKS

5.1 As discussed in Section 1 above, it is understood that a full-storey basement is proposed under the existing semi-detached property, extending from just in front of the property to behind the house and into the garden.

5.2 The current work was therefore commissioned to provide information on the sub-soil conditions at this site, together with laboratory testing, in order to allow foundations to be designed and a Basement Impact Assessment (BIA) to be undertaken by others.

FOUNDATION DESIGN

5.3 Underlying paving, MADE GROUND was encountered in both boreholes to a depth of between 0.60m and 0.70m below existing ground level. Beneath the MADE GROUND, silty CLAY was encountered to a depth of 4.60m in borehole BH1 and was not penetrated in borehole DIS2 at the termination depth of 5.00m below existing ground level. Underlying the silty CLAY in borehole BH1, clayey silty SAND was encountered up to a depth of 6.20m below existing ground level. Beneath the clayey silty SAND in borehole BH1, very silty CLAY was then encountered which was not penetrated at the borehole termination depth of 10.00m below existing ground level.

5.4 From the evidence of the boreholes, basement excavations may require support in the short term in the MADE GROUND and silty CLAY stratum encountered, and we would recommend that a contingency is allowed for this at this stage.

5.5 Groundwater was encountered during boring in boreholes BH1 and DIS2 between 4.50m and 5.50m depth and during the initial two return visits to the installation within borehole BH1 at depths of between 5.34m and 5.39m below existing ground level and borehole DIS2 at depths of between 2.57m and 2.71m below existing ground level. Therefore, should water accumulate at the base of new basement excavations it is very important that these are kept dry by, for example, pumping from a sump, the foundation base is kept square and that any soft spots are replaced and compacted prior to pouring foundation concrete.

5.6 Further, we recommend that where groundwater or surface water flows into foundation basement excavations, 'blinding' concrete is used at the base of the foundation excavations and that foundation concrete is poured as soon as possible thereafter.

5.7 For conventional strip or pad foundations set below any MADE GROUND, within the underlying silty CLAY at 1.25m depth, an allowable bearing pressure of 100 kN/m^2 could be adopted. This could be increased to some 125 kN/m^2 at 2.00m depth and 150 kN/m^2 at 3.00m depth.

5.8 Settlement due to the above noted order of loadings would not be expected to exceed 20-25mm.

5.9 The results of the Atterberg Limit tests indicate that the underlying silty Clay would have a 'medium' potential for swelling and/or shrinking in accordance with the National House Building Councils (NHBC) classification system given in Part 4 of their Standards. Precautions against shallow foundation sides in the form of compressible material, will, therefore, be required at this site where they fall within the 'zone of influence' of any past, existing or any proposed trees.

5.10 It should be noted that should ground conditions differing significantly from those described in our report be encountered during foundation excavation, then Risk Management Limited should be contacted immediately and that the above noted allowable bearing pressure or recommended foundation type may need to be altered accordingly.

BASEMENT

5.11 As discussed in paragraph 5.7 above, an allowable bearing pressure of 150 kN/m^2 could be adopted for strip or pad footings founding at the assumed new basement depth of approximately 3.00m. However, to keep settlements to within acceptable limits any uniformly distributed load on the basement slab itself should be kept to a minimum.

5.12 Note that, even if groundwater is not encountered during basement construction, there is always a possibility that the basement excavation will act as a local "sump" for surface groundwater and run-off. Therefore, we would recommend that the basement construction is "tanked" to prevent any future problems with ingress of groundwater.

RETAINING STRUCTURES

5.13 The full design of temporary and permanent retaining structures is beyond the scope of this report. However, the following values are given as a guide to assist in the design of these structures in the underlying silty CLAY encountered down to assumed basement level at this site.

Parameter	Value
Bulk Density (γ)	1.95 Mg/m^3
Dry Density (γ_d)	1.55 Mg/m^3
TOTAL STRESS DESIGN (Temporary Works Only)	
Undrained Cohesion (C_u)	50-100 kN/m^2 increasing with depth
Undrained Angle of Internal Friction (ϕ_u)	0^o
Wall Adhesion – Active (c_w)	= 0.5 * C_u but max 50 kN/m^2
Wall Adhesion – Passive (c_w)	= 0.5 * C_u but max 25 kN/m^2
EFFECTIVE STRESS DESIGN (Permanent Works)	
Effective Cohesion (c’)	1 kN/m^2
Effective Angle of Internal Friction (ϕ’)	20^o
Wall Adhesion – Active (c_w)	0 kN/m^2
Wall Adhesion – Passive (c_w)	0 kN/m^2
Wall Friction – Active (δ)	0.66ϕ’
Wall Friction – Passive (δ)	0.50ϕ’

BURIED CONCRETE

5.14 The results of the chemical tests at this site indicate that the samples tested, down to 1.50m depth, would fall into Class DS-1 of the Building Research Establishments (BRE) classification system.

5.15 However, owing to the presence of selenite crystals within the silty Clay, we would recommend that a minimum of Class DS-2 is used for any buried concrete mix design.

LANDFILL GAS

5.16 During the initial two return gas/groundwater monitoring visits to the installation fitted within borehole BH1, no Methane was detected with a “trace” of Carbon Dioxide up to 1.0% but no flow was recorded. Oxygen concentrations were between 18.0% and 19.5%.

5.17 The monitoring equipment’s flow detection limit of 0.1 l/hr will be used to calculate the maximum hazardous gas concentration.

5.18 With reference to BS 8485:2015 Section 6 and Section 7:

From Clause 6.3.4, the maximum hazardous gas flow rate (in litres per hour) is calculated by:-

$Q_{hg} = q(C_{hg}/100)$ where;

q is the measured flow rate (in litres per hour) of combined gases from the monitoring standpipe.

C_{hg} is the measured hazardous gas concentration (in percentage volume/volume).

Therefore, for the highest CO_2 level recorded in borehole DIS2, $Q_{hg} = 0.1(1.0/100)$
$= 0.0010$ l/h

From Clause 6.3.7.4 - The calculated Q_{hg} is adopted as the worst-case Gas Screening Value (GSV) therefore the site characteristic GSV = 0.0010 l/h

From Clause 6.4 - Table 2 the site characteristic situation (CS) is shown to be CS1 which has a **“very low”** hazard potential.

From Table 3 - The building is type A.

From Table 4 – The minimum gas protection score required for this site is 0 (zero).

Therefore, based on the initial two monitoring visits, no land borne gas remedial measures would be required at this site.

PRELIMINARY CONTAMINATION ASSESSMENT

5.19 Part IIA of the Environmental Protection Act 1990 contains the legislative framework for the regulation of contaminated land and this was implemented in the Contaminated Land (England) Regulations 2000. This legislation allows for the identification and remediation of land where contamination is causing unacceptable risks to human health or the wider environment. The approach adopted by the UK contaminated land policy is “suitable for use” which implies that the land should be suitable for its current use and made suitable for any known future use.

5.20 For this ***Preliminary Contamination Assessment*** the site has been modelled using the Source-Pathway-Receptor approach to produce a Conceptual Site Model.

Source	(substances or potential contaminants which may cause harm)
Pathway	(a linkage route between the source and receptor)
Receptor	(something which may be harmed by the source e.g. humans, plant, groundwater

5.21 <u>Source</u>

Two shallow samples of MADE GROUND, one from borehole BH1 at 0.50 depth and one from borehole DIS2 at 0.50m depth, were selected and tested for a range of commonly occurring contaminants and indicators of contamination including those given by the Contaminated Land Exposure Assessment (CLEA).

5.22 <u>Pathways</u>

The pathways needing to be considered, as discussed above, will depend on the land usage, and will include for, example; soil ingestion, inhalation of vapour and dust, and consumption of home-grown vegetables, where this is applicable.

5.23 Receptors

From the results of the current work, the following potential receptors have been identified.

- Workers on the site likely to come into contact with the soils.
- Users of property and gardens.
- Any proposed additional vegetation.
- Neighbours
- Controlled waters
- Infrastructure
- Structures

5.24 It should be noted that the CLEA software has limited functionality and contains algorithms, which the EA has publicly expressed its intention to update. As a consequence of this, some of the screening values generated by the CLEA software may not adequately reflect specific site conditions and, in some instances, are unduly conservative. In addition, it should also be noted that the figures given in the appended table are based on a 6% soil organic matter content.

5.25 The DEFRA/EA model has been developed on the basis of many critical assumptions about possible exposure to soil contamination and the development of conceptual exposure models to describe different land uses as follows:

- *Residential with consumption of home-grown fruit and vegetables*
- *Residential without consumption of home-grown fruit and vegetables*
- *Allotments*
- *Commercial*

5.26 The Contaminated Land Exposure Assessment (CLEA) model was originally published in March 2002 as joint DEFRA/EA publications; Contaminated Land Research (CLR) Report CLR 10, with Reports CLR7, 8 and 9 as supporting documents, providing toxicity data and human tolerable daily intake (TDI) data to be used with this model. This model enabled the derivation of more site-specific values for contaminants present on a site, rather than the use of 'generic' values, which were previously used.

5.27 DEFRA/EA previously published a number of Soil Guideline Values (SGVs) for certain determinands, (common toxic metals), which were generic guideline criteria for assessing the risks to human health from chronic exposure to soil contamination for standard land-use functions. However, these were withdrawn in late 2008 and DEFRA/EA have now issued a new set of guidance documents. With regard to the Risk Management Limited standard suite of tests, currently SGV figures have only been issued for Arsenic, Cadmium, Mercury, Nickel, Phenols and Selenium.

5.28 In the absence of currently published SGV values for the remaining contaminants, Messrs. W. S. Atkins have derived ATRISK^{soil} Soil Screening Values (SSVs) which have been updated using CLEA v1.071 to incorporate changes to exposure assessment parameters, methodology, and land uses as set out in the Department for Environment, Food and Rural Affairs (Defra) Category 4 Screening Level (C4SL) Project Methodology Report.

5.29 Full details of how the SSVs have been derived and general notes as to their use are given on the ATRISK website and are available from Risk Management Limited upon request. A few of the PAH levels have not been updated and have been left as per the previous CLEA v1.04 derivation.

5.30 The SGV and SSV levels represent “intervention” levels above which the levels of contamination may pose an unacceptable risk to the health of site-users such that further investigation and/or remediation is required.

5.31 Total Petroleum Hydrocarbons are considered in accordance with the fractions proposed by The Environment Agency, drawing on the TPHCWG methodology. These are contained in Table 4.2 – Petroleum hydrocarbon fractions for use in UK human health risk assessment, based on Equivalent Carbon (EC) number, contained in Science Report P5-080/TR3, *The UK Approach for Evaluating Human Health Risks from Petroleum Hydrocarbons in Soils.*

5.32 The contamination results have been compared with the ***Residential with consumption of home-grown fruit and vegetables*** criteria as shown on the table below. Any exceedences are highlighted in yellow on the appended Laboratory Test Results sheets.

Determinand (below)		Units	Residential with consumption of home-grown fruit and vegetables.	Residential without consumption of home-grown fruit and vegetables.	Allotments.	Commercial.
			ATRISK Contaminated Land Screening Values (SSV) derived using CLEA v1.071 as set out in DEFRA Category 4 Screening Levels (C4SL) Methodology. 6% SOM Sandy Loam.			
Aliphatic Hydrocarbons	(mg/kg)	C5-C6	369	371	6110	29400
		C6-C8	1240	1240	18300	98200
		C8-C10	204	205	2390	14800
		C10-C12	1180	1190	8960	69500
		C12-C16	4130	2710	16300	139000
		C16-C35	210100	212000	477000	3620000
Aromatic Hydrocarbons	(mg/kg)	C8-C10	232	332	73.9	20800
		C10-C12	468	1550	95.9	53800
		C12-C16	830	2710	176	65400
		C16-C21	1040	1930	321	28400
		C21-C35	1710	1930	1570	28400
TOTAL TPH						
Naphthalene		mg/kg	12.2	13.1	27.4	1050
Acenaphthylene		mg/kg	-	-	-	-
Acenaphthene		mg/kg	2760	6730	680	106000
Fluorene		mg/kg	2610	4860	796	72000
Phenanthrene		mg/kg	-	-	-	-
Anthracene		mg/kg	26200	37700	11300	544000
Fluoranthene		mg/kg	2980	5050	1010	72600
Pyrene		mg/kg	2120	3780	679	54400
Benz(a)anthracene		mg/kg	8.54	9.04	10.3	10.3
Chrysene		mg/kg	2.64	2.64	2.64	2.64
Benzo(b)fluoranthene		mg/kg	7.29	7.29	7.29	7.29
Benzo(k)fluoranthene		mg/kg	4.12	4.12	4.12	4.12
Benzo(a)pyrene		mg/kg	4.95	5.34	5.72	76.3
Indeno(123-cd)pyrene		mg/kg	9.75	10.3	16.6	144
Dibenz(ah)anthracene		mg/kg	1	1.03	2.57	14.4
Benzo(ghi)perylene		mg/kg	103	104	342	1450
TOTAL PAH						
Cyanide (Free)		mg/kg	34	34	34	373
pH		unit	-	-	-	-
Copper (Total)		mg/kg	4790	9060	1450	106000
Lead (Total)		mg/kg	200	313	79.1	2310
Zinc (Total)		mg/kg	20300	47000	5230	1100000
Chromium III		mg/kg	14300	16700	12600	208000
Chromium (Hexavalent)		mg/kg	20.5	20.5	171	49.1
			CLEA Soil Guideline Values (SGV)			
Benzene		mg/kg	0.33	0.998	0.07	95
Toluene		mg/kg	610	2710	120	4400
Ethylbenzene		mg/kg	350	843	90	2800
Xylenes		mg/kg	230	321	160	2600
Arsenic (Total)		mg/kg	32	35	43	640
Cadmium (Total)		mg/kg	10	83.6	1.8	230
Mercury (Total)		mg/kg	170	238	80	3600
Nickel (Total)		mg/kg	130	130	230	1800
Phenols (Total)		mg/kg	420	519	280	3200
Selenium (Total)		mg/kg	350	595	120	13000

ASSESSMENT OF RESULTS

5.33 No samples had determinands exceeding the CLEA Soil Guideline Values (SGV) for ***Residential with consumption of home-grown fruit and vegetables*** usage.

5.34 However, both samples tested were found to have elevated levels of Lead and the sample from borehole BH1 was found to also have elevated levels of Arsenic and the Polyaromatic Hydrocarbons (PAH), Chrysene, Benzo(k)fluoranthene and Benzo(a)pyrene, when compared against the ATRISK Contaminated Land Screening Values (SSV) for ***Residential with consumption of home-grown fruit and vegetables*** usage.

5.35 Asbestos was not identified in the two samples tested.

5.36 ***Discussion***

No remedial measures would be required for MADE GROUND beneath the new property or any associated hardstanding.

The elevated levels of Lead, Arsenic and PAH's encountered within the MADE GROUND would only be relevant to proposed landscaped areas. Therefore, for any new planting areas, we would recommend removal of any MADE GROUND, to a minimum depth of 600mm, and replacement with some 300mm-400mm of "clean" imported material overlain by 200mm-300mm of "clean" Topsoil as necessary.

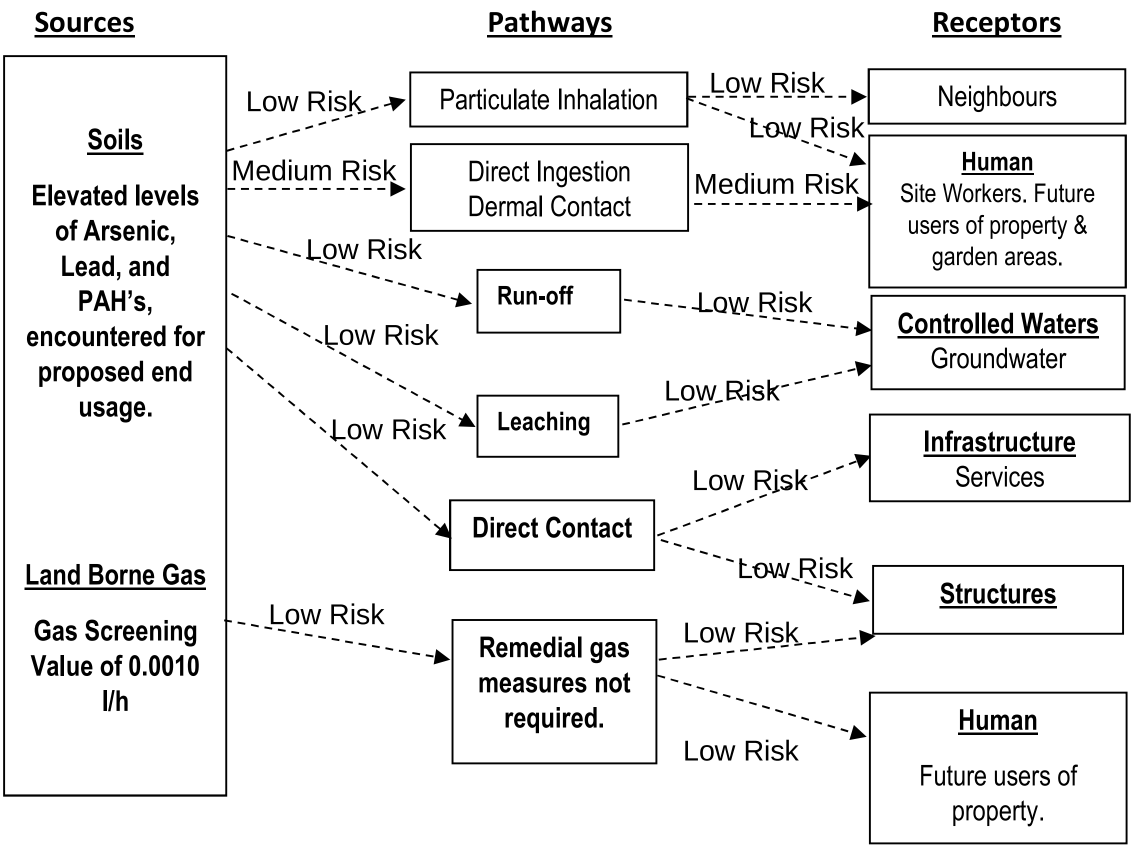
The presence of elevated levels of Lead, Arsenic and PAH's in the MADE GROUND should be noted by Groundworkers and included within the main contractors site method statements and risk assessments.

Any material removed from site should be sent to a suitably licensed landfill and waste tickets should be retained. In addition, any imported "clean" material and/or topsoil should be certified as 'clean' and suitable for use. The waste tickets and certification will need to form part of a final Verification Report for the site in due course.

In addition, to any precautions regarding the presence of Lead, Arsenic and PAH's as noted above, we would recommend that standard Health and Safety precautions be taken with regard to ground workers at this site and these should include PPE equipment such as gloves, overalls etc. and normal washing facilities available on-site.

CONCEPTUAL SITE MODEL (CSM)

5.37 The following diagram summarises the potential pollution linkages identified for this site in the form of a diagrammatic Conceptual Site Model (CSM).



5.38 By employing the measures discussed in paragraph 5.36 above, the above noted 'medium' risks could be reduced to 'low' risks.

5.39 As always, the above recommendations are based on a selected number of representative samples and further testing may be required if any significant contamination is suspected or encountered during ground works.

SOIL SAMPLES

5.40 All soil samples will be kept for a period of 28 days after the date of the invoice for this project unless otherwise notified to Risk Management Limited in writing. Should samples be required to be stored for longer than 28 days then a storage charge may be levied.

Prepared By : Richard Price B.Sc., F.G.S., M.I.Env.Sc.
Project Engineer

Checked By : Malcolm S. Price B.Sc., M.Sc., M.I.C.E., C.Eng., M.I.Env.Sc.
Director

Distribution : Simpson Associates

The recommendations made and the opinions expressed in this report are based on the borehole records, examination of samples and the results of site and laboratory tests.

The report is issued on the condition that Risk Management Limited will under no circumstances be liable for any loss arising directly or indirectly from ground conditions between the boreholes or trial pits which have not been shown by the boreholes, trial pits or other tests carried out during the investigation.

In addition, Risk Management Limited will not be liable for any loss whatsoever arising directly or indirectly from any opinion given on the possible configuration of strata both between the borehole and/or trial pit positions and/or below the maximum depth of the investigation. Such opinions, where given, are for guidance only.

Groundwater levels may also vary with time from those reported during our site investigation due to factors such as tidal conditions, heavy pumping from nearby wells or seasonal changes.

No person other than the client to whom this report is addressed, shall rely on it in any respect and no duty of care shall be owed to any such third party.

Risk Management

Risk Management Limited
Unit 10 Coopers Place
Combe Lane
Godalming
Surrey GU8 5SZ

Borehole Log

Borehole No. **BH1**

Sheet 1 of 1

Project No. RML 7096	**Coordinates:**	**Drilling Technique:** Light Percussion Rig	**Level (m):**
Site Address: 20 Ferncroft Avenue, Hampstead, NW3 7PH	**Date:** 13/08/2019	**Diameter (mm):** 200	**Scale:** 1:50

Stratum Description	Depth (m)	Level (m)
Paving	0.15	
MADE GROUND (crushed roadstone).	0.30	
MADE GROUND (brick fill).	0.60	
Firm to stiff brown silty CLAY with pockets of orange-brown and grey silt and occasional selenite crystals. *becoming grey-brown in colour with pockets of red-brown and orange-brown silt from 3.00m depth*	4.60	
Medium-dense, orange-brown, clayey, silty fine SAND.	6.20	
Soft to firm grey very silty CLAY with pockets of orange-brown silt and occasional selenite crystals. *becoming grey in colour from 7.10m depth*	10.00	
Borehole terminated at 10.00m depth		

Samples and In Situ Testing

Depth (m)	Sample Type	Test Type	Results
0.15	D1		
0.50	D2		
1.00	D3		
1.50	D4		
2.00	D5	SPT	N=15 (3,3/3,4,4,4)
2.50	D6		
3.00	D7		
3.50	D8		
4.00	D9	SPT	N=12 (4,4/3,2,3,4)
4.50	D10		
5.00	D11		
5.50	D12		
6.00	D13	CPT	N=21 (5,5/5,6,5,5)
6.50	D14		
7.00	D15		
7.50	D16		
8.00	D17		
8.50	D18		
9.00	D19		
9.50	D20		
10.00	D21		

Water Strikes | Well

Remarks: Service pit excavated to 1.20m depth. Groundwater encountered at 5.50m depth. Standpipe installed to 6.50m depth. No SPT results from 6.00m owing to presence of groundwater.

KEY

D = Disturbed Sample
U = Undisturbed Sample
B = Bulk Sample
W = Water Sample

CPT = Cone Penetration Test
SPT = Standard Penetration Test
V = Vane Test
PP = Pocket Penetrometer
MEXE = Insitu CBR test

AGS

Risk Management

Risk Management Limited
Unit 10 Coopers Place
Combe Lane
Godalming
Surrey GU8 5SZ

Borehole Log

Borehole No. **DIS2**
Sheet 1 of 1

Project No. RML 7096	**Coordinates:**	**Drilling Technique:** Drive-in-Sampler	**Level (m):**
Site Address: 20 Ferncroft Avenue, Hampstead, NW3 7PH	**Date:** 14/08/2019	**Diameter (mm):** 75	**Scale:** 1:50

Stratum Description	Legend	Depth (m)	Level (m)	Samples and In Situ Testing: Depth (m)	Sample Type	Test Type	Results	Water Strikes	Well
Paving		0.15		0.15	D1				
MADE GROUND (clinker and brick fill).		0.70		0.50	D2				
Firm to stiff brown silty CLAY with pockets of orange-brown and grey silt and occasional selenite crystals.				1.00	D3				
				1.50	D4				
				2.00	D5				
				2.50	D6				
				3.00	D7				
				3.50	D8				
				4.00	D9				
				4.50	D10			▼	
Borehole terminated at 5.00m depth		5.00		5.00	D11				

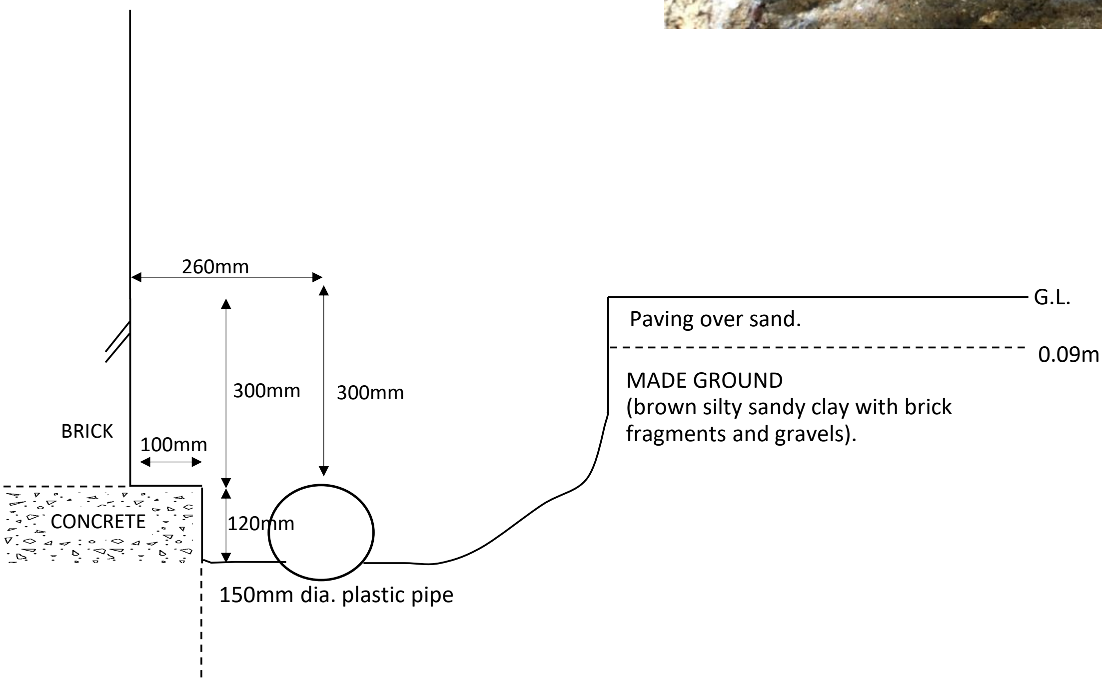
Remarks: Service pit excavated to 1.20m depth. Groundwater encountered at 4.50m depth. Standpipe installed to 5.00m depth. Borehole terminated at 5.00m depth owing to 'hard driving'.

KEY

D = Disturbed Sample
U = Undisturbed Sample
B = Bulk Sample
W = Water Sample

CPT = Cone Penetration Test
SPT = Standard Penetration Test
V = Vane Test
PP = Pocket Penetrometer
MEXE = Insitu CBR test

AGS



Underside of foundation not determined

Risk Management	Title : **TRIAL PIT 1**		
	Project Location : 10 Ferncroft Avenue, Hampstead, NW3 7PH		
RECORD OF HAND EXCAVATED TRIAL PIT	Job No : RML 7096	Scale : Not To Scale	
	Figure No. **1**	Date : 14 Aug.2019	